MISCELLANEOUS.

Geological Survey of England.

Mr. E. T. Newton, F.R.S., F.G.S., of the Jermyn Street Museum, retired from the office of 'Palæontologist' to the Geological Survey on May 4th, carrying with him the regret and esteem of a large number of friends and colleagues with whom he has served for forty years.

Dr. F. L. Kitchin, M.A., F.G.S., assistant palæontologist in the Museum, has been appointed to succeed him.

Geological Survey of Ireland.

The Geological Survey of Great Britain and Ireland.—The Irish Branch of the Geological Survey has been transferred to the Department of Agriculture and Technical Instruction for Ireland, and placed under the immediate direction of Professor G. A. J. Cole.

The Geological Survey in Ireland was begun at about as early a date as that in England. Indeed, at the commencement of the Trigonometrical Survey, Colonel Colby expressed his opinion that the work "should be considered a foundation for Statistical, Antiquarian, and Geological Surveys." About the year 1832 Captain (afterwards General) J. E. Portlock undertook the formation of a geological department, and in 1837, by Colonel Colby's desire, he formed at Belfast "a museum for geological and zoological specimens, and a laboratory for the examination of soils." From that date the Geological Survey became an organized branch of the Trigonometrical Survey under the Master-General and Board of Ordnance. In 1840 the Belfast Museum was broken up, and everything connected with the geological department was moved to Dublin.[1] About four years later the Geological Surveys were placed under the Office of Woods and Forests, and Sir H. T. De la Beche then became Director-General of the Geological Survey of the United Kingdom. The first Local Director for Ireland was Captain (afterwards Colonel Sir Henry) James; he was shortly succeeded by Dr. Thomas Oldham, who held office until 1850, when Professor J. B. Jukes[2] and after him Professor E. Hull filled the post of Director. Meanwhile in 1854 the Geological Survey was transferred to the Science and Art Department, which in recent years has been merged in the Board of Education.

[1] Preface to Portlock's Report on the Geology of Londonderry, etc., 1843.

[2] See Address by Jukes, "On Her Majesty's Geological Survey," delivered at the Museum of Irish Industry, 1866; 8vo; Dublin, 1867.

THE

GEOLOGICAL MAGAZINE.

NEW SERIES. DECADE V. VOL. II.

No. VII.—JULY, 1905.

ORIGINAL ARTICLES.

I.—Notes on British Dinosaurs. Part III: *Streptospondylus*.

By Dr. Francis Baron Nopcsa.

(PLATE XV.)

After having studied a bipedal and a quadrupedal Orthopodous Dinosaur I thought it desirable to turn my attention to a bipedal representative of the Saurischian order.[1]

Though *Streptospondylus* is by no means an exclusively British Dinosaur, since the type-specimen is preserved in the Jardin des Plantes in Paris, and was described under the names *Streptospondylus* and *Megalosaurus* by Cuvier and Gaudry, still, the only other specimen known, and by far the best, is in Mr. J. Parker's private collection at Oxford. It is to Mr. Parker's kindness that I owe the possibility of studying and drawing what may be called one of the most complete Theropods ever found, while in the Paris Collection *Streptospondylus* is only represented by several vertebræ, a fragment of the femur, and the distal part of the tibia with the corresponding astragalus. Mr. Parker's specimen includes the skull, most of the cervical, dorsal, sacral, and some of the caudal vertebræ, the scapulo-coracoid, parts of both humeri, the ilium, ischium, parts of the pubis, both femora, tibiæ, and fibulæ, some tarsal and all the metatarsal bones, and several phalanges.

[1] The quite exceptional economic *rôle* of Dinosaurs during the greater part of the Mesozoic era justifies, I believe, the quite exceptional term 'subclass Dinosauria.' The term Opisthocœlia, as recently and persistently used by some American authors, is decidedly a misnomer, for besides being absolutely misleading—since opisthocœlian vertebræ occur among Sauropoda, Theropoda, and Orthopoda—it was originally not even used for a defined group of Dinosaurs, but for what might be called a *potpourri* of Dinosaurian and Crocodilian reptiles. If one wants to emphasize the fact that Theropoda and Sauropoda form a unit in consequence of their showing greater affinities to each other than to the Orthopoda, cf. Hulke's paper on *Dystrophæus* the term Saurischia, as clearly defined by Professor Seeley, is applicable to these reptiles. I desire to protest most energetically against the use of the term 'Opisthocœlia.'

(The smaller parts represent the bones actually known.)

Since a detailed description of *Streptospondylus* is far beyond the scope of this paper, I intend to publish such a description in the *Beiträge zu Geologie und Palaeontologie* (Vienna), and here, in accordance with my previous Notes on British Dinosaurs, only the most salient points will be mentioned. First of all, it has to be remarked that Mr. Parker's fossil indicates a much smaller and, as the structure of the sacrum shows, a more immature individual than that in the Paris Museum.

The *skull*, which is altogether missing in the Paris specimen, is nearly complete in the Oxford individual, but in consequence of being imperfectly freed from the matrix I could only identify maxillary, præmaxillary, dentary, basis cranii, and quadratum. The greatest possible disproportion is to be remarked between the facial and the cerebral region. The huge jaws are built after the *Megalosaurus* pattern, and the same is also true with regard to the long, compressed, trenchant, and serrated teeth. There exist two, perhaps even three, anteorbital apertures, as in *Creosaurus* and *Megalosaurus*, while in *Ceratosaurus* there is only one. The quadratum is relatively short and points to the existence of a *Creosaurus*-like quadrato-squamosal arch. The short basis cranii shows a strong transverse expansion of the brain in the region of the vagus nerve. The brain-cavity was a good deal larger than the neural canal in the sacral region, and its large size[1] is easily explained by the comparatively high intelligence that *Streptospondylus* must have possessed as an agile carnivorous reptile. Tubera basi-occipitalia seem to be wanting. The diameter of the ball-like occipital condyle cannot have exceeded 2·5 cm.

Vertebræ. The foremost cervical vertebræ are remarkable for their small size, the centra being only 4 cm. long and 2·5 cm. high, while the posterior cervicals attain 6·0 and 3·5 cm., and some dorsals even 8 and 4·5 cm. The neural spines are but feebly developed; the arch shows, much like the primitive Sauropoda, a complex system of diapophysial, oblique, præzygapophysial, postzygapophysial, and horizontal laminæ, and differs in consequence from all the other known Theropods. The centra of the cervical vertebræ are unlike those of *Ceratosaurus*, *Creosaurus*, and the Triassic Theropods, strongly convex in front, deeply concave behind, and show large pleurocentral fossæ.

In the dorsal vertebræ the antero-posteriorly blade-like neural spines are better developed than in the cervicals, the arch is again supported by different laminæ, and the centra pass from a convexo-concave to a plano-concave and further on to a nearly biconcave stage. As we pass backward along the dorsal region the pleurocentral cavities become gradually less pronounced, so that in the posterior dorsals they are altogether wanting. The centra of the sacral vertebræ, though united in the Paris specimen, are free in the *Streptospondylus* in Mr. Parker's collection and show here saddle-shaped intersacral articulations.

[1] I am fully aware this expression seems a euphemism when one thinks of modern reptiles, but it is not so when one thinks of such vegetable-feeders as *Stegosaurus* or *Triceratops*.

The number of the sacral vertebræ seems in *Streptospondylus* to have been augmenting during lifetime from 3 to 4, perhaps even to 5 or more.[1] In general the sacrum shows a great resemblance to that of *Megalosaurus*, whereas in consequence of the development of different laminæ in the dorsal vertebræ—a feature absent in *Megalosaurus*—these parts as well as the cervical region are totally different in these two reptiles.

The biconcave and hourglass-shaped, transversely cylindrical caudal vertebræ in *Streptospondylus* are likewise different from the similarly biconcave and constricted but transversely wedge-shaped caudals of *Poikilopleuron*.[2] As in the caudals of most Dinosaurs, the posterior facet for the chevron bone is much more marked than the anterior, which in this case is nearly altogether wanting.

The rod-like chevrons are both distally and proximally united; they are less compressed and comparatively shorter than in *Iguanodon*, and they are supposed not to have extended so far backwards.

Scapulo-coracoids. Even in the immature Oxford specimen the scapula and the coracoid are firmly united. The blade-like scapula is somewhat concave on the inner side and in consequence somewhat convex on the outer, and is much more slender than in *Megalosaurus*, showing in its upper half that the borders are parallel. Inferiorly it expands rapidly towards the margin of the coracoid. It forms, with the semicircular coracoid, a very shallow glenoidal fossa of rectangular outline. There is no scapular crest or acromion-like process; these are altogether wanting.

Humerus. As in all Theropoda, the humerus is very weak, but perfectly distinct from the same much more massive bone in *Megalosaurus*, or the more slender but still powerful humerus in *Poikilopleuron*. The different development of the radial crest in each case affords a good characteristic.

Pelvis. The imperfect ilium shows in general, as pointed out by Philips, some resemblance to *Megalosaurus*; the proximally expanded, distally rod-like ischium seems, however, to be somewhat different. The pubis shows no obturator foramen.

Posterior limb. The femur is somewhat longer than the tibia. The head of the femur shows quite a distinct neck, the trochanter major is weaker than in *Allosaurus* and situated lower than the head, the well-developed fourth trochanter, situated at the beginning of the upper third of the femur, shows the *trochanter en crête* pattern. The shaft of the femur is somewhat curved and nearly cylindrical in section.

Comparing the outline of the fourth trochanter of *Streptospondylus* or *Allosaurus* with the figure given by Hulke for *Zanclodon* or the outline visible in *Euskelesaurus* (in the Vienna femur), and then the

[1] It is quite a common thing to find in the synsacrum of the Upper Cretaceous Dinosaurs 8–10 vertebræ, lumbosacrals, sacrals, and caudosacrals firmly united. Besides *Claosaurus* and *Triceratops* this is also the case in the sacra of two not yet described Transylvanian Dinosaurs.

[2] Careful original studies have convinced me that the type-specimens of *Poikilopleuron* and the Stonesfield *Megalosaurus* (*M. Bucklandi*) are perfectly distinct.

(The shaded parts represent the bones actually known.)

same part in the Senonian *Megalosaurus Bredai*, one remarks that the same sort of change and diminution as I pointed out among the Ornithopodidæ can also be traced among the Theropoda, in consequence of which I feel unable to accept Hulke's statement that in the Theropoda the *trochanter en crête* represents a more primitive type than the pendant trochanter.

Distally the femoral ectocondyle of *Streptospondylus* shows a smaller posterior projection, much like that in *Megalosaurus*, *Allosaurus*, and the bird *Apteryx*, while in *Iguanodon* and some birds (for example, *Cygnus*) this part is constructed after another fashion. The distal end of the strong tibia is one of the few fragments of limb bones preserved in the Paris specimen, but this, I regret to say, has been described and figured as *Megalosaurus*, and only the complete tibiæ of Mr. Parker's specimen show that the fragment in reality belongs to *Streptospondylus*, from which it has been separated for nearly a hundred years.

As the proportion of femur and tibia among Dinosaurs seems to be of the greatest interest, since it appears that among all Dinosaurs there exists a tendency to elongate the femur, a list of ten Dinosaurs is here given in which the proportion of femur to tibia is expressed according to the formula femur : tibia = x : 1.

Genus.	Bipedal.		Quadrupedal.	
	Theropoda.	Orthopoda.	Sauropoda.	Orthopoda.
Ornithomimus	0·58 : 1	—	—	—
Nanosaurus	—	0·84 : 1	—	—
Hallopus	0·87 : 1	—	—	—
Anchisaurus	1·02 : 1	—	—	—
Trachodon	—	1·17 : 1	—	—
Megalosaurus	1·27 : 1	—	—	—
Cetiosaurus	—	—	1·32 : 1	—
Scelidosaurus	—	—	—	1·33 : 1
Apatosaurus	—	—	1·62 : 1	—
Stegosaurus	—	—	—	1·8 : 1

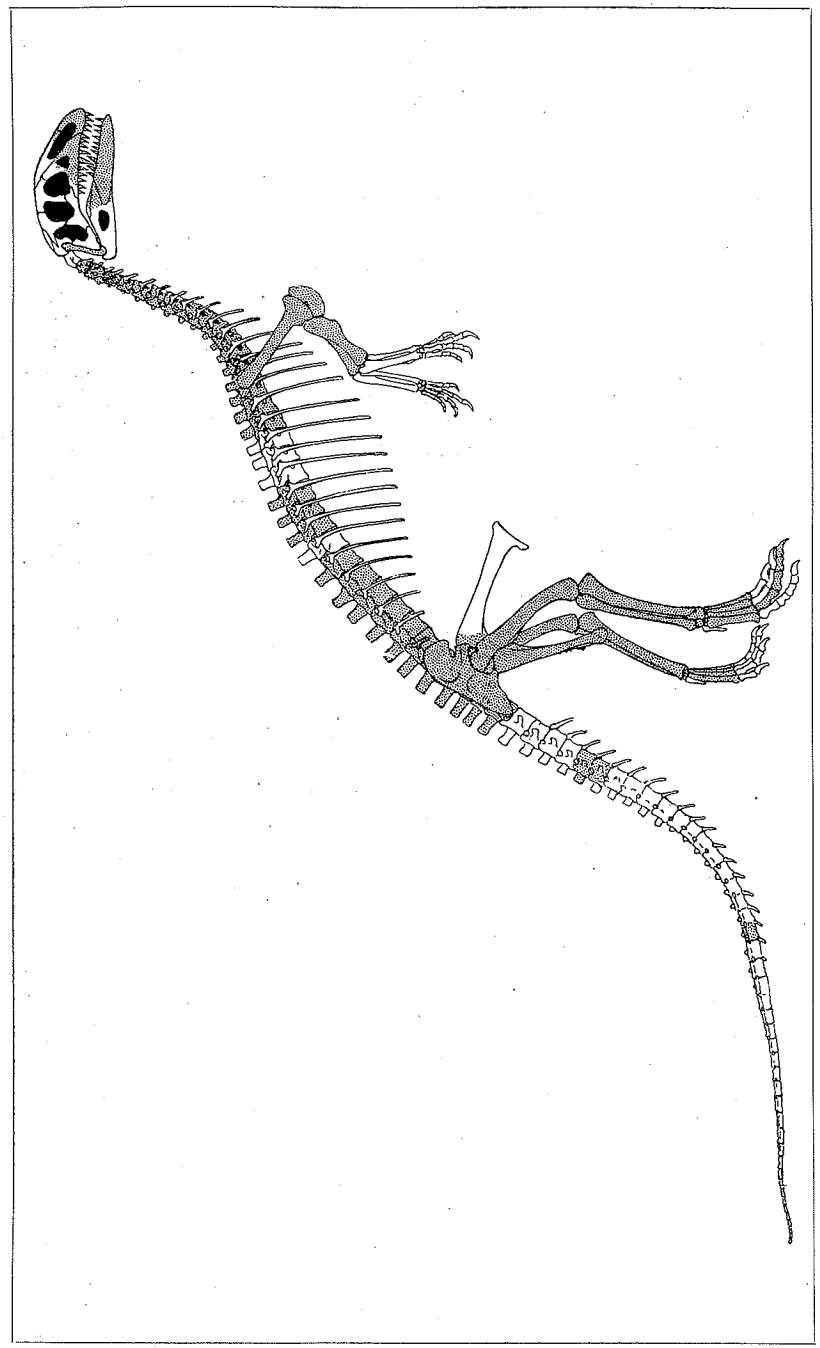
(Italics indicate Triassic or primitive forms.)

A more complete list, containing 24 genera, will be given in my later paper on *Streptospondylus*.

The proximally expanded fibula of *Streptospondylus* is conspicuous on account of its slender character, especially when compared with the robust form of the associated tibia. In consequence of this disproportion it seems much more slender than in either *Creosaurus*, *Allosaurus*, or the Triassic forms. It does not show any trace of distal expansion.

In the *astragalus*, which is applied firmly to, but not united with, the calcaneum, a well-developed ascending process is always present, but never reaches so high as in *Poikilopleuron*. As in the latter animal it is applied against a projection of the tibia. I wish

Geol. Mag. 1905. Dec. V, Vol. II, Pl. XV.



Restoration of the skeleton of *Streptospondylus*, from the Oxford Clay of Oxford.

Reconstructed by Dr. Francis Baron Nopcsa from the original specimen in Mr. J. Parker's collection.
(The shaded parts represent the bones actually known.)

to refer to a former paper[1] for the phylogenetic value of the ascending process. In opposition to what is known of *Allosaurus* and *Megalosaurus*, there are in *Streptospondylus* in each foot four well-developed metatarsal bones, each bearing well-developed toes armed with claws. The claws show the carnivorous pattern.

With the superior crest of the ilium Mr. Parker's nearly complete *Streptospondylus* stood about 4 ft. 9 in. from the ground, and the Paris specimen may have been 6 feet in height; the total length of these two animals was probably 20 and 27 feet. *Megalosaurus*, we may assume, may have attained a maximum length of 30 feet.

Plate XV accompanying this notice gives a reconstruction of *Streptospondylus* as based on the study of Mr. J. Parker's fossil, and Miss A. B. Woodward has had the great kindness to make this drawing according to my directions. The large skull, the feeble but flexible neck, the weak anterior and powerful posterior limbs are well shown.

The principal differences of *Streptospondylus* and other Theropoda have already been pointed out in different parts of this paper; here I wish only to refer once more to the Sauropod-like build of the vertebral column. That the Sauropoda descended from bipedal Saurischia I intend to discuss upon some other occasion. The specific name of the only kind of *Streptospondylus* known till now is *Strept. Cuvieri* (H. v. Meyer); the horizons at which the genus occurs are the Callovian in France and the Oxford Clay at Oxford in England.

EXPLANATION OF PLATE XV.

Reconstruction of *Streptospondylus* (the shaded parts indicate the bones that are actually known).

II.—An Account of some Marine Fossils contained in Limestone Nodules found on the Mekran Beach, off the Ormara Headland, Baluchistan.

By R. Bullen Newton, F.G.S.

(PLATES XVI AND XVII.)

THROUGH the kindness of Miss Caroline Birley, of Kensington, I have been privileged to examine a collection of fossil marine shells and other organisms in her possession, which occur in drab-coloured, gritty, and siliceous limestone nodules picked up on the beach off the Ormara Headland, facing the Mekran or Baluchistan coast, 130 miles west of Karachi, by Mr. F. W. Townsend, chief executive officer of the Submarine Telegraph Service in the North Indian Ocean.

So far as the present specimens demonstrate, the nodules vary in size from two to about four inches in diameter, many of them being as round as a ball with perfectly even surfaces, to which are

[1] Nopcsa, "Synopsis und Abstammung der Dinosaurier": Földtani Közlöny, Budapest, 1901.